

Laser Shock Peening in Additive Manufacturing

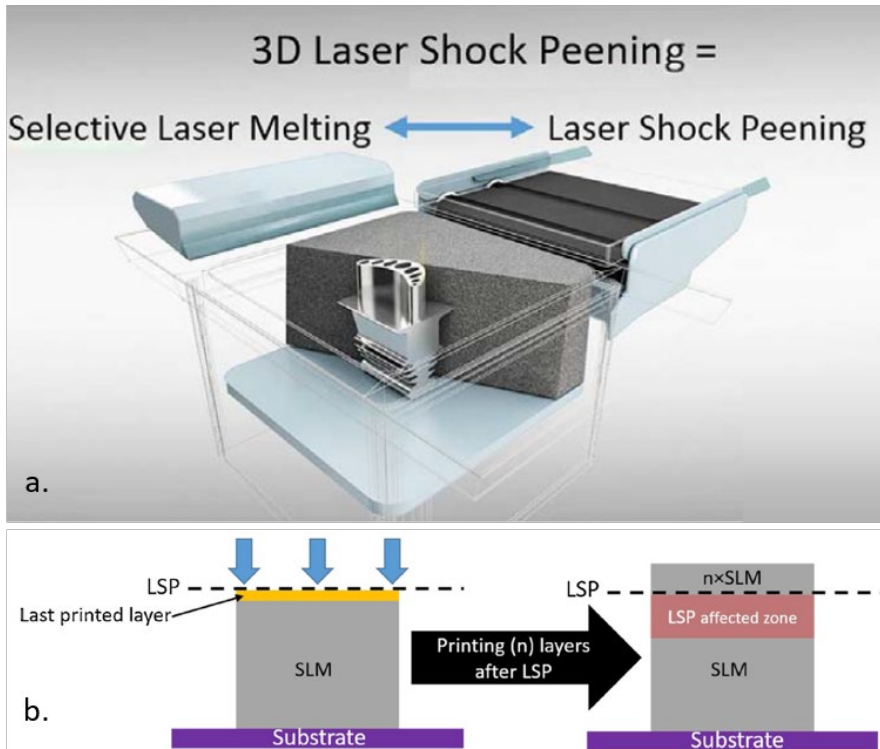


Illustration of a 3D Laser Shock Peening process (3D-LSP) with n number of rebuilt SLM layers after the LSP treatment.

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Keywords

3D Laser Shock Peening (LSP), Selective Laser Melting (SLM), Additive Manufacturing (AM), residual stress, fatigue, hardness, porosity, healing cracks

Intellectual Property

(1) EP3147048B1
 (2) PCT/IB2019/059448

Publications

[Healing cracks in SLM by 3D-LSP](#)

[3D LSP - A new method for improving fatigue properties of SLM parts](#)

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Description

3D Laser Shock Peening (LSP) is a novel hybrid additive manufacturing process. It combines 2 lasers during the building phase of the part. The 1st one melts the metallic powder and creates parts with complex geometries (SLM). The 2nd laser is applied periodically, directing high-intensity laser pulses on the part, sending shock waves through the material.

3D LSP treatment decreases the high tensile residual stresses that accumulate during the building phase and creates parts with tailored residual stress field, i.e. parts that have beneficial compressive residual stress in the near surface region.

The fatigue life of the produced part treated is increased by more than 14 times compared to a regular SLM produced part. Cracks are reduced by more than 95% while distortions are decreased by more than 75%.

Advantages

- Increased material fatigue life.
- Reduced crack density, i.e. ability to print Nickel based superalloys.
- Higher material hardness.
- Reduced stress relaxation during high cycle and high temperature applications.
- Increased stability of material microstructure, crack healing.
- Unprecedented metal resistance to high temperature, damage, fretting and corrosion.
- Plastic deformation refines the material grain size.

Applications

- Additive Manufacturing
- Power generation, eg. Turbine
- Aircraft engine parts, eg. nozzles
- Medical and dental, eg. Hip implants